AAPM Standard of Practice: CT Protocol Review Physicist

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Goals

- Understand purpose and importance of CT Protocol Review
- Understand AAPM MPPG 1.a.
- Understand roles of protocol review committee
- Demonstrate team member contributions through real-life examples

AAPM Medical Physics Practice Guideline 1.a: CT Protocol Management and Review Practice Guideline

- JACMP 14(5): 3-12, 2013
- AAPM website
  - http://www.aapm.org/pubs/MPPG/documents/MPPG1a.pdf

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Staff Assigned to Committee - 2013 Roster

(dates shown below are start and end dates of position. this is only viewable by EXCOM, Staff and the chair of TG225)
There are 1 staff.

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2/1/2012 AAPM Staff - *Legislative and Regulatory Affairs Manager - (ex officio, nonvoting)*

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The AAPM will periodically define new practice guidelines for medical physics practice to help

AAPM Medical Physics Practice Guideline 1.a. AAPM CT Protocol Management and Review Practice Guideline

approval of the Professional Council. The medical physics practice guidelines recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice guidelines and technical standards by those entities not providing these services is not authorized.

Approved [March 8, 2013]*

AAPM Medical Physics Practice Guideline 1.a.
AAPM CT Protocol Management and Review Practice Guideline

Organization of the Practice Guideline

1. Introduction
2. Definitions
3. Staffing Qualifications and Responsibilities
4. Essential Elements of the Protocol Management Process
5. Conclusion
6. References

Introduction

- The **review and management of computed tomography** (CT) protocols is a facility's ongoing mechanism
  - of ensuring that exams being performed achieve the desired diagnostic image quality
  - at the lowest possible radiation dose
  - exploiting the capabilities of the equipment

- Protocol review and management is an essential activity in ensuring patient safety and that diagnostic images are produced.

- The AAPM considers these activities to be essential to any quality assurance (QA) program for CT, and as an ongoing investment in improved quality of patient care.

Introduction

- Review, implementation and verification of protocols within a practice
- **Complex undertaking** in the present environment
- Challenges in optimization of dose and image quality are compounded by a lack of automated mechanisms to collect and modify protocols
- Manual labor involved in this process is NOT inconsequential

Application of the MPPG

- This MPPG **only applies** to CT scanners used for diagnostic imaging. **It is not applicable** to scanners used **exclusively** for:
  - Therapeutic radiation treatment planning or delivery;
  - Only calculating attenuation coefficients for nuclear medicine studies; or
  - Image guidance for interventional radiologic procedures.

However, CT protocol review is encouraged in these settings!!

The Team

- **Must** be responsible for protocol design and review of all parameter settings.
- Each team member brings different expertise and may have different responsibilities in the Protocol Review and Management process.
- To be successful, it is very important that the expectations of roles and responsibilities of each member are clearly described.
- The ability to work together as a team will be important attributes of each member of this group.

Team Members

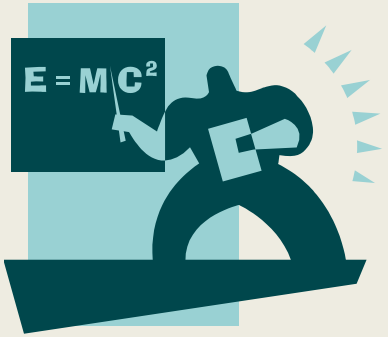
- Lead Radiologist
- Lead CT Technologist
- QMP
- Maybe an administrator

Other duties for this team???

- CT Accreditation
  - Planning
  - Submission
- Radiation Protocol Committee
  - Recent Texas regulations
  - Add Radiation Safety Officer

Responsibilities of the QMP

- QMP's responsibilities may vary, but the QMP **must be** involved in the review of all protocols.
- Involvement in protocol process may depend on status of QMP – in house vs consultant
- In-house QMP expected to be more immersed than consultant, devote more time & effort



Lead Radiologist

- Often will function as team leader (maybe not in large facilities)
- Driver for image quality requirements
  - Contrast?
  - Image thickness? Recon kernel?
  - Multi-phase? Timing?
  - Acceptable noise level
  - Special post-processing

Lead Technologist

- May be single point person or shared duty
- Patient handling issues
  - Oral contrast requirements
  - Patient positioning
  - Injection delays
  - Breathing instructions
  - Post-processing
- Usually source of best information about CT scanner capabilities & limitations

The Protocol Management Review Process

- All new or modified protocol settings for existing and new scanners
- Ensure that both image quality and radiation dose aspects are appropriate.
- Review of existing protocols
- Implementation of new and innovative technologies that can improve image quality and/or lower patient dose in comparison to the older protocol.

The Protocol Management Review Process (continued)

- Specific capabilities of each individual scanner
  - minimum rotation time
  - automatic exposure controls
  - tube current modulation
  - kV selection technologies
  - reconstruction algorithms
  - iterative reconstruction
- Achieve maximum performance of the system

- It **should** include a review of the most current literature.

Considerations Important During Review of a Protocol

- **Recommendations for State and National Guidance**
  - The QMP **must** be familiar with applicable federal law and the specific requirements for the state or local jurisdiction where the facility is located.
  - Protocol review and management, while not always explicitly required by state law or regulation, may often facilitate compliance with many provisions within state laws and regulations relating to radiation dose from CT.

Considerations Important During Review of a Protocol (continued)

- **Frequency of Review**
  - The review process **must** be consistent with federal, state and local laws and regulations.
  - If there is no specific regulatory requirement, the frequency of protocol review **should** be no less frequent than 24 months.
  - This review **should** include all new protocols added since the last review.
  - However, the best practice would be to review the most-frequently-used protocols at least annually.

Protocols that Require Annual Review

If a facility performs the **following six clinical protocols**, the CT Protocol Review and Management team **must** review these annually (or more frequently if required by state or local regulatory body).

- Pediatric Head (1 year old) (if performed)
- Pediatric Abdomen (5 year old; 40-50 lb. or approx. 20 kg) (if performed)
- Adult Head
- Adult Abdomen (70 kg)
- High Resolution Chest
- Brain Perfusion (if performed)

Clinically Significant Protocols that Require Annual Review

- Facilities that do not perform these “six protocols” **must** select other protocols at their facility:
  - most frequently performed or
  - higher-dose protocols
  - total at least six protocols for annual review.

Considerations Important During Review of a Protocol (continued)

- **Protocol Naming**
  - Consider naming CT protocols in a manner consistent with the RSNA RadLex Playbook (soon to release new version).
    - Provides a more consistent experience for patients and allows more direct comparison among facilities.
    - Allows more direct utilization of the ACR Dose Index Registry tools and
    - Provides more efficient automated processes with post-processing workstations.
  - Appropriate protocol naming may result in fewer technologist errors and allow more efficient comparison of protocol parameters between scanners.
  - Consider incorporating version dates in protocol names.

Considerations Important During Review of a Protocol (continued)

- **Permissions**
  - Document who has permission to change protocol parameters on the scanner(s).
  - Use of password protection is encouraged if available.
  - Document process of making protocol adjustments and the frequency of these adjustments.
  - Include approvals & documentation process (e.g., a change control log documenting the rationale and who authorized or motivated the change).

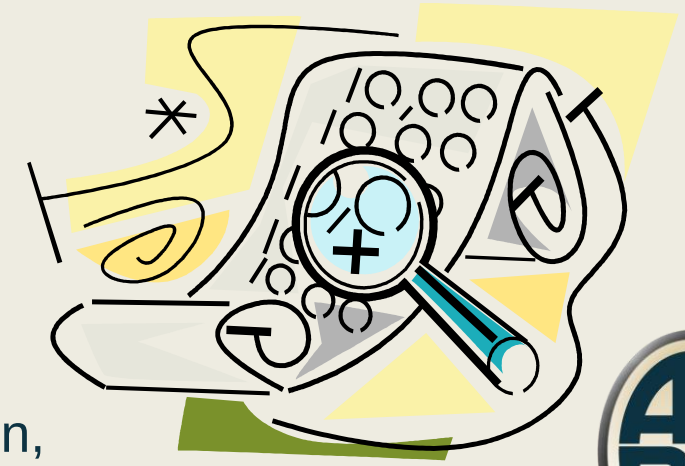
Helpful Tool

- Method for keeping track of protocol review status
  - Outline steps required
  - Log process to date
  - Process may stall and need to be restarted
  - Running list of all protocols in flux
  - Waiting list of those to tackle next

Considerations Important During Review of a Protocol (continued)

- **Acquisition Parameters** **should** be reviewed to ensure they are appropriate for the diagnostic image quality
  - noise level
  - spatial resolution
  - minimizing radiation dose
  - For example, a slow rotation time and/or low pitch value would not be appropriate for a chest CT exam due to breath-hold issues.

- Parameters include:
  - kV,
  - mA,
  - rotation time,
  - collimation or detector configuration,
  - pitch, etc.



Considerations Important During Review of a Protocol (continued)

- **Reconstruction parameters** **should** also be reviewed to ensure appropriate diagnostic image quality necessary for the clinical indication(s) for the protocol.

- The parameters include:
  - image thickness
  - reconstruction interval
  - reconstruction algorithm/kernel/filter
  - the use of additional image planes (e.g., sagittal or coronal planes, etc.)

Considerations Important During Review of a Protocol (continued)

- **Advanced dose reduction techniques should be considered** provided the use of such techniques is consistent with the goals of the exam.
- Depending on the capabilities of each specific scanner, consider use of the following if they are available:
  - Automatic exposure control (e.g., tube current modulation or kV selection) methods
  - Iterative reconstruction techniques

Considerations Important During Review of a Protocol (continued)

- **Adjustments of acquisition parameters should** be adjusted for <u>patient size</u>
  - manual adjustments (technique chart)
  - automatic methods (such as
    - tube current modulation
    - kV selection

Considerations Important During Review of a Protocol (continued)

- **Radiation dose management tools**
  - Identify potentially high radiation dose scans being prescribed. MITA XR25 standard (“CT Dose Check”).
  - Monitor doses from routine exams and collect data. These would allow statistical analysis of dose parameter values for a specific exam or clinical indication (e.g., average $CTDI_{vol}$ for a routine non-contrast head).
    - Participation in a national registry (such as the ACR Dose Index Registry).
    - Commercial products now available for this purpose.

Considerations Important During Review of a Protocol (continued)

- **Populating Protocols Across Scanners**
  - Process by which protocol parameters are populated across additional scanners
    - manually
    - copy/paste
  - ‘Master’ scanners in the facility where manual protocol adjustments are made and archived, and that set of protocols moved to the other similar scanners, or if another strategy will be employed.

Considerations Important During Review of a Protocol (continued)

- **Documentation**
  - All changes to protocols and historical protocols **should** be available for review.
  - Include the rationale for changes.
  - Latest protocol **should** be readily and obviously available to users during clinical protocol selection.
  - Who is responsible for maintaining the overall protocol description documentation.
  - Describe whether the protocol description documentation is accessible to others for reference, how often it is updated and how all protocols are archived.

Considerations Important During Review of a Protocol (continued)

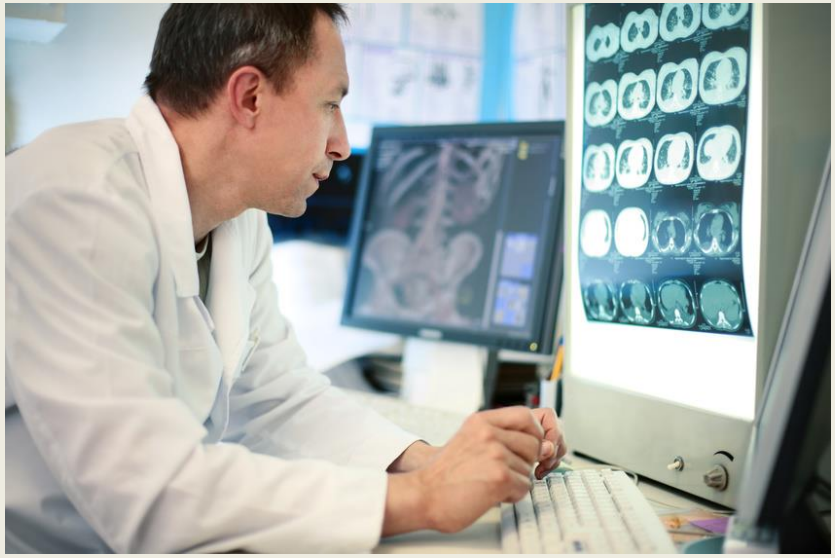
- **Periodic vendor specific education/refresher sessions**
  - Each member of the CT Protocol Management Process team **should** receive refresher training no less than annually or when new technology is introduced that substantially impacts image quality or dose to the patient.
    - Available educational resources **should** be considered in order to keep staff updated on current best practices.
    - Periodic refresher training **should** be scheduled for all members of the CT Protocol Management Process team.

Considerations Important During Review of a Protocol (continued)

- **Verification**
  - Regular review process of protocols to be sure that no unintended changes have been applied that may degrade image quality or unreasonably increase dose.
  - As a best practice, the CT Protocol Review and Management team **should** conduct a random survey of specific exam types to verify that the protocols used are acceptable and consistent with protocols specified above.
    - Acquisition and reconstruction parameters
    - Image quality
    - Radiation dose

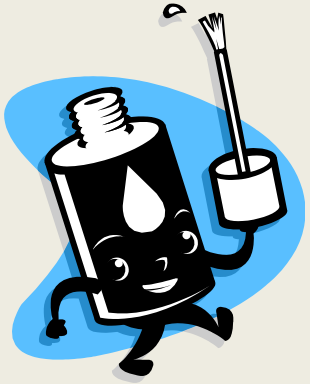
CT Protocol Review Examples

- Last 3 CT protocol reviews at MD Anderson:
  - Liver CT Exam
  - Pediatric Abdomen CT Exam
  - Liver CT Protocols



Example 1

- Siemens scanner Liver exam –
  - Radiologist: “thin images are missing”
  - Technologist: they are not included in the protocol
  - QMP: radiation dose quite high for all passes?!?
    - Same quality reference mAs used for all passes
    - Big Woops
  - Corrections made regarding acquisition & reconstruction parameters



Example 2

- QMP: ACR Accreditation testing - pediatric abdomen dose levels VERY LOW. Unlikely to pass low-contrast test.
- Radiologist: we've been complaining about noisy pediatric abdomen images for ages, GO FOR IT…
- Technologist: be careful when increasing mA; pediatric scan field of view imposes an mA limit.

- Solution: increased dose to all pediatric abdomen/pelvis exam protocols.
- Image quality reference parameter and/or kV

Example 3

- Everyone: we have TOO MANY liver protocols!
- Pre-surgical, routine, GSI liver, etc…
- Radiologist: Need better and more consistent image quality than we are getting now.
- Technologist: There are too many protocols to choose from (easy to make an error).
- QMP: We can design a single protocol for this exam that has the IQ needed for all patients.
- Results: Less confusion, more consistent IQ, fewer complaints.

Conclusion

- CT protocol management and review is a critical part of a CT facility's operation
- Considered important by many state regulatory bodies, accrediting and professional organizations.
- Protocol parameter control and periodic review will help
  - maintain the facility's image quality to acceptable levels
  - assure patient safety
  - continuous improvement in the imaging practice.